(c) The BSNL will install a second booth when it is convinced that the customer would expect waiting for at least 3 minutes for their turn to make a call. By how much time should the flow of customers increase in order to justify a second booth?

(d) Estimated the fraction of a day that the phone will be in use.

(e) What is the probability that it will take him more than 10 minutes altogether to wait for phone and complete his call?

Shanmuga Industries Arts & Science College T.V.Malai

APRIL/MAY 2025

23PECM14B — OPERATIONS RESEARCH

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. State any four applications of operations research.
2. What are slack and surplus variables?
3. List three approaches used with T.P transportation problem.
4. Why is A.P a completely degenerate form of a T.P?
5. When do you say a game is stable?
6. Define two person zero sum game.
7. Give the meaning of Individual replacement.
8. How is dangling avoided in network?
9. State the meaning of queuing model.
10. Expand (a) PERT and (b) CPM.

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) What are the uses of Operations research?

Or

(b) Using graphical method to solve the LPP

Maximize $Z = 3x_1 + 2x_2$;

Subject to $5x_1 + x_2 \geq 10$;

$x_1 + x_2 \geq 6$

$x_1 + 4x_2 \geq 12$

$x_1, x_2 \geq 0$

12. (a) Obtain the initial basic feasible solution of a transportation problem whose cost and rim requirement tale is given below:

Origin/Destination	D_1	D_2	D_3	Supply
O_1	2	7	4	5
O_2	3	3	1	8
O_3	5	4	7	7
O_4	1	6	2	14
Demand	7	9	18	34

Or

19. A project is represented by the network shown below and has the following table:

Task	A	B	C	D	E	F	G	H	I
Least Time	5	18	26	16	15	6	7	7	3
Greatest Time	10	22	40	20	25	12	12	9	5
Most Likely time	8	20	33	18	20	9	10	8	4

Determine the following:

(a) Expected time of tasks and their variance

(b) The critical path

(c) The probability of completing the project with n 41.5 weeks.

20. The rate of arrival of customers at a public telephone booth follows Poisson distribution with an average time of 10 minutes between the customer and the next. The duration of the phone call is assumed to follow exponential distribution, with mean time of 3 minutes.

(a) What is the probability that a person arriving at the booth will have to wait?

(b) What is the average length of the non-empty queues that form from time to time?

Surplus Cities	Deficit Cites				
	a	b	c	d	E
A	85	75	65	125	75
B	90	78	66	132	78
C	75	66	57	114	69
D	80	72	60	120	72
E	76	64	56	112	68

Determine the optimum assignment schedule.

18. Find the sequence for the following 8 is that will minimize the total elapse time for the completion of all the jobs. Each job is processed in the same order:

Timer for machine	Jobs							
	1	2	3	4	5	6	7	8
A	4	6	7	4	5	3	6	2
B	8	10	7	8	11	8	9	13
C	5	6	2	3	4	9	15	11

The entries give the time on hours on the machine.

(b) There are four jobs to be assigned to five machines only one job can be assigned to one machine. The amount of time in hours required for the jobs per machine is given in the following matrix.

Job	Machine				
	A	B	C	D	E
1	4	3	6	2	7
2	10	12	11	14	16
3	4	3	2	1	5
4	8	7	6	9	6

Find an optimum assignment of jobs to the machine to minimize the total processing time and also find for which machine no job is assigned what is the total processing time to complete the entire job?

13. (a) We have seven jobs each of which has to go through the machines, M_1 and M_2 n the order M_1, M_2. Processing time (in idle hours) are given as:

Job	1	2	3	4	5	6	7
Machine I	3	12	15	6	10	11	9
Machine II	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time.

Or

(b) In a game of matching coins with two players, suppose A wins one unit of value when there are two heads, wins nothing when there are two tails and losses ½ units of value when there are one head and one tail. Determine the pay-off matrix, the best strategies for each player and the value of the game to A.

14. (a) A firm s considering replacement of a machine, whose cost price s Rs. 12,200 an the scrap value Rs. 200. The running (Maintenance and operating) cost in rupees is found from experience to be as follows:

Year	1	2	3	4	5	6	7	8
Running cost	200	500	800	1200	1800	2500	3200	4000

When should the machine be replaced?

Or

(b) Explain the distinction between PERT and CPM.

15. (a) What is decision tree analysis? State the steps in decision tree analysis.

Or

(b) A T.V repairman find that the time spent on his job has an exponential distribution with mean 30 minutes. If the repair sets in the order in which they came in, and of the arrival of sets is approximately Poisson with an average rate of 10 per 8 hours day, what is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Solve by Big M method.

Maximize: $Z = x_1 + 2x_2 + 3x_3 - x_4$

Subject to $x_1 + 2x_2 + 3x_3 = 15$

$2x_1 + x_2 + 5x_3 = 20$

$x_1 + 2x_2 + x_3 + x_4 = 10$

17. A pharmaceuticals company is producing a single product and is selling it through five agencies locate in different cities. All of a sudden, there is a demand for the product in another five cites not having any agency of the company. The company is face with the problem of deciding on how to assigns the existing agencies to dispatch the product to needy cities in such a way that the travelling distance is minimize. The distance between the surplus and deficit cites (in K.M) is given in the following table: